

Solving Quadratics with the Quadratic Formula

- ① Make sure equation $= 0$
- ② Find $a, b,$ and c
- ③ Plug in values
- ④ Simplify discriminant
- ⑤ Finish simplifying

Quadratic Formula The Quadratic Formula can be used to solve any quadratic equation once it is written in the form $ax^2 + bx + c = 0$.

Quadratic Formula

The solutions of $ax^2 + bx + c = 0$, with $a \neq 0$, are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Example

Solve $x^2 - 5x = 14$ by using the Quadratic Formula.

- ① Rewrite the equation as $x^2 - 5x - 14 = 0$ ② $a = 1$ $b = -5$ $c = -14$
- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Quadratic Formula

③ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-14)}}{2(1)}$ Replace a with 1, b with -5 , and c with -14 .

$= \frac{5 \pm \sqrt{81}}{2}$ Simplify.

$= \frac{5 \pm 9}{2} \rightarrow \frac{5+9}{2} = \frac{14}{2} = 7$

$= \frac{5-9}{2} \rightarrow \frac{5-9}{2} = \frac{-4}{2} = -2$

The solutions are -2 and 7 .

Roots and the Discriminant

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Discriminant

The expression under the radical sign, $b^2 - 4ac$, in the Quadratic Formula is called the **discriminant**.

Roots of a Quadratic Equation

Discriminant	Type and Number of Roots
$b^2 - 4ac > 0$ (positive)	2 real solutions
$b^2 - 4ac = 0$	1 real solution
$b^2 - 4ac < 0$ (negative)	2 complex solutions i in my answer

Example

Find the value of the discriminant for each equation. Then describe the number and types of roots for the equation.

a. $2x^2 + 5x + 3$ $a=2$ $b=5$ $c=3$

The discriminant is

$b^2 - 4ac = 5^2 - 4(2)(3) = 1$

The discriminant is a perfect square, so the equation has 2 rational roots.

2 real solutions

b. $3x^2 - 2x + 5$ $a=3$ $b=-2$ $c=5$

The discriminant is

$b^2 - 4ac = (-2)^2 - 4(3)(5) = -56$

A. The discriminant is -56 , so the

B. equation has 2 complex solutions

C. $x = \frac{-(-2) \pm \sqrt{-56}}{2(3)} = \frac{2 \pm i\sqrt{56}}{6}$

6-5

Skills Practice

The Quadratic Formula and the Discriminant

Complete parts a–c for each quadratic equation.

- a. Find the value of the discriminant. *$b^2 - 4ac$*
 b. Describe the number and type of roots. *use chart*
 c. Find the exact solutions by using the Quadratic Formula.

1. $x^2 - 8x + 16 = 0$

2. $x^2 - 11x - 26 = 0$

3. $3x^2 - 2x = 0$

4. $20x^2 + 7x - 3 = 0$

5. $5x^2 - 6 = 0$

6. $x^2 - 6 = 0$

7. $x^2 + 8x + 13 = 0$

8. $5x^2 - x - 1 = 0$

9. $x^2 - 2x - 17 = 0$

10. $x^2 + 49 = 0$

11. $x^2 - x + 1 = 0$

12. $2x^2 - 3x = -2$

Solve each equation by using the method of your choice. Find exact solutions.

13. $x^2 = 64$

14. $x^2 - 30 = 0$

15. $x^2 - x = 30$

16. $16x^2 - 24x - 27 = 0$

17. $x^2 - 4x - 11 = 0$

18. $x^2 - 8x - 17 = 0$

19. $x^2 + 25 = 0$

20. $3x^2 + 36 = 0$

21. $2x^2 + 10x + 11 = 0$

22. $2x^2 - 7x + 4 = 0$

23. $8x^2 + 1 = 4x$

24. $2x^2 + 2x + 3 = 0$

25. **PARACHUTING** Ignoring wind resistance, the distance $d(t)$ in feet that a parachutist falls in t seconds can be estimated using the formula $d(t) = 16t^2$. If a parachutist jumps from an airplane and falls for 1100 feet before opening her parachute, how many seconds pass before she opens the parachute?